IN THE SPECIFICATION:

Please amend the paragraph beginning at page 4, line 15, as follows:

Japanese Patent Application Laid-Open No. H11-310495 discloses a technique of adding ~~phosphor~~ phosphorus to an i-layer of μc-Si:H thin film to a ratio of 1ppm .

Please amend the paragraph beginning at page 4, line 18, as follows:

Japanese Patent Application Laid-Open No. H11-317538 discloses a technique of adding ~~phosphor~~ phosphorus-containing gas to the raw material gas to a ratio between about 10ppm and about 1,000ppm in order to form an n^- layer in a photovoltaic element having a $p^+n^-n^+$ junction of μc-Si:H thin film.

Please amend the paragraph beginning at page 10, line 9, as follows:

The inventor of the present invention found a phenomenon that the spectral sensitivity of a single cell having an i-layer of μc-Si:H thin film can be controlled for a specific wavelength by adjusting the ~~phosphor~~ phosphorus (P) content ratio of the i-layer of the single cell and got to the present invention by applying the above phenomenon to current balance adjustment of a stacked cell (triple cell in particular) with intensive research efforts.

Please amend the paragraph beginning at page 11, line 5, as follows:

Preferably, said spectral sensitivity adjusting atoms are ~~phosphor~~ phosphorus (P) atoms.

Please amend the paragraph beginning at page 11, line 7, as follows:

In another aspect of the invention, there is provided a photovoltaic element containing a structure formed by sequentially arranging a metal layer, a lower transparent conductive layer, a first n-layer of non-single-crystal silicon, a first i-layer of microcrystal silicon, a first p-layer of non-single-crystal silicon, a second n-layer of non-single-crystal silicon, a second i-layer of microcrystal silicon and a second p-layer of non-single-crystal silicon on a support body, said first i-layer and said second i-layer containing ~~phosphor~~ phosphorus (P) and the content ratio R1 of ~~phosphor~~ phosphorus to silicon of the first i-layer and the content ratio R2 of ~~phosphor~~ phosphorus to silicon of the second i-layer is defined by the formula of

$R2 < R1$.

Please amend the paragraph beginning at page 12, line 6, as follows:

With the current balance adjustment method according to the invention, the spectral sensitivity of the stacked cell relative to a specific wavelength is adjusted by causing the i-layers of μc-Si:H thin film to contain spectral sensitivity adjusting atoms and adjusting the current balance of the stacked cell. The mechanism involved in the method will be described in greater detail hereinafter. With the current balance adjustment method according to the invention, it is possible to raise or lower the sensitivity of the stacked cell relative to light with a wavelength band between 550 nm and 800 nm without changing the band gap of the i-layers by adjusting the ~~phosphor~~ phosphorus content ratio of the i-layers of μc-Si:H thin film. The adjustment range is modified by changing the ~~phosphor~~ phosphorus content ratio between about 0.1ppm and about 4ppm so that there is no risk

that the instability at the time of forming the layers entails reduction in the conversion efficiency and in the yield factor of stacked cells of the type under consideration.

Please amend the paragraph beginning at page 13, line 9, as follows:

FIG. 3 is a graph illustrating the relationship between the ~~phosphor~~ phosphorus concentration of the i-layer and the Voc characteristic of the photovoltaic element of FIG. 2;

Please amend the paragraph beginning at page 13, line 13, as follows:

FIG. 4 is a graph illustrating the relationship between the ~~phosphor~~ phosphorus concentration of the i-layer and the FF characteristic of the photovoltaic element of FIG. 2;

Please amend the paragraph beginning at page 13, line 17, as follows:

FIG. 5 is a graph illustrating the relationship between the ~~phosphor~~ phosphorus concentration of the i-layer and the Jsc characteristic of the photovoltaic element of FIG. 2;

Please amend the paragraph beginning at page 13, line 21, as follows:

FIG. 6 is a graph illustrating the relationship between the ~~phosphor~~ phosphorus concentration of the i-layer and the conversion efficiency of the photovoltaic element of FIG. 2;

Please amend the paragraph beginning at page 13, line 25, as follows:

FIG. 7 is a graph illustrating the relationship between the ~~phosphor~~ phosphorus concentration of the i-layer and the spectral sensitivity characteristic of the photovoltaic element of FIG. 2;

Please amend the paragraph beginning at page 14, line 2, as follows:

FIG. 8 is a graph illustrating the relationship between the ~~phosphor~~ phosphorus concentration of the i-layer and the spectral sensitivity characteristic of the photovoltaic element of FIG. 2;

Please amend the paragraph beginning at page 16, line 12, as follows:

The work obtained by laying a metal layer 103 and a lower transparent conductive layer 104 on a support body 102 is referred to as substrate 121 herein. Then, a first n-layer 105 of a-Si:H:P thin film, a ~~phosphor~~ phosphorus-containing first i-layer 106 of μc-Si:H thin film, a first pi-layer 107 of a-Si:H thin film, a first p-layer 108 of a-Si:H:B or μc-Si:H:B are sequentially formed on the substrate 121 by CVD. The multilayer structure including the above four layers is referred to as bottom cell 122.

Please amend the paragraph beginning at page 16, line 22, as follows:

Then, a second n-layer 109 of a-Si:H:P thin film, a ~~phosphor~~ phosphorus -containing second i-layer 110 of μc-Si:H thin film, a second pi-layer 111 of a-Si:H thin film, a second p-layer 112 of a-Si:H:B or μc-Si:H:B are sequentially formed on the bottom

cell 122 also by CVD. The multilayer structure including the above four layers is referred to as middle cell 123.

Please amend the paragraph beginning at page 18, line 17, as follows:

The inventor of the present invention found a phenomenon that the spectral sensitivity of a single cell having an i-layer of μc-Si:H thin film can be controlled for a specific wavelength by adjusting the ~~phosphor~~ phosphorus concentration of the i-layer of the single cell and applied this phenomenon to current balance adjustment of a triple cell. Therefore, firstly the phenomenon will be described below.

Please amend the paragraph beginning at page 19, line 7, as follows:

FIGS. 3 through 6 are graphs illustrating the relationships between the ~~phosphor~~ phosphorus concentration of the i-layer and various characteristics of the single cell of FIG. 2 obtained by controlling the volume of PH_3 gas introduced simultaneously with SiH_4 gas, SiF_4 gas and H_2 gas into the vacuum chamber that was used for forming the i-layer 203 of the single cell by CVD. As seen from the graphs, the relationship between the P concentration in the i-layer and Voc (see FIG. 3) and the relationship between the P concentration in the i-layer and FF (see FIG. 4) show a substantially same tendency. More specifically, both Voc and FF increase monotonically until the P content ratio gets to 1ppm from the lower side and the rate of increase is reduced beyond 1ppm of the P content ratio until they become saturated. As for the relationship between the P concentration in the i-layer and Jsc, Jsc decreases monotonically as the P concentration in the i-layer increases

(see FIG. 5). As for the relationship between the P concentration in the i-layer and the conversion efficiency, the conversion efficiency monotonically increases until the P concentration gets to 2ppm from the lower side and then slowly and monotonically decreases beyond 2ppm of the P concentration (see FIG. 6). It will be appreciated from the graphs that the highest conversion efficiency is realized when the P concentration in the i-layer of μc-Si:H thin film of a single cell is found at or near 2ppm.

Please amend the paragraph beginning at page 20, line 9, as follows:

Since both the i-layer of μc-Si:H thin film of the bottom cell and that of the middle cell of a stacked photovoltaic element according to the invention contain ~~phosphor~~ phosphorus, the two cells show a high FF value and therefore the triple cell including the two cells also shows a high FF value. Particularly, the bottom cell shows very high Voc and FF values due to the ~~phosphor~~ phosphorus it contains. While the Jsc value decreases as the ~~phosphor~~ phosphorus concentration rises as seen from FIG. 5, the spectral sensitivity relative to light with a wavelength range above 800 nm is sufficient for the bottom cell as seen from FIG. 8. Additionally, the spectral sensitivity of the middle cell is sufficient for a middle cell as seen from FIG. 7 because the ~~phosphor~~ phosphorus concentration of the middle cell is low.

Please amend the paragraph beginning at page 21, line 7, as follows:

It is believed that a large number of amorphous regions normally exist in high quality μc-Si:H thin film that is used for photovoltaic elements and ~~phosphor~~ phosphorus is deposited exclusively in amorphous regions or on crystal grain boundaries.

Many dangling bonds of silicon exist on crystal grain boundaries of μc-Si:H thin film in which amorphous regions are practically not found. However, dangling bonds are quite rare on crystal grain boundaries of μc-Si:H thin film in which many amorphous regions exist because gaps separating crystals are surrounded by amorphous regions. The i-layers of μc-Si:H thin film in a photovoltaic element according to the invention are basically in such a state. However, local levels attributable to dangling bonds and structural strains will not be completely removed in such a state. If ~~phosphor~~ <u>phosphorus</u> is put into μc-Si:H thin film in such a state, ~~phosphor~~ <u>phosphorus</u> in crystals seem to move to crystal boundaries and become bonded to hydrogen atoms in amorphous regions in the process of forming the photovoltaic element to consequently inactivate dangling bonds.

Please amend the paragraph beginning at page 22, line 9, as follows:

However, since the small number of ~~phosphor~~ <u>phosphorus</u> atoms that are added to amorphous regions do not move during the thin film forming process and hence amorphous regions turn to slightly n-type regions, it may be safe to assume that depletion is prevented from occurring. Therefore, probably absorption takes place only in absorbing regions of amorphous silicon and the sensitivity to light with a wavelength range between 550 nm and 800 nm is reduced to by turn reduce the short circuit current as the ~~phosphor~~ <u>phosphorus</u> concentration increases. The fact that the dangling bond density of high quality μc-Si:H thin film is about 1×10^{15} to 1×10^{16} ($1/cm^3$) and the concentration of the added ~~phosphor~~ <u>phosphorus</u> is of the order of 1×10^{16} ($1/cm^3$) also suggests the above described mechanism.

Please amend the paragraph beginning at page 22, line 25, as follows:

If PH_3 gas is used as raw material gas when ~~phosphor~~ phosphorus is introduced into μc-Si:H thin film, PH_2* is excited in plasma so that probably the following reactions take place on the outermost surface.

Please amend the paragraph beginning at page 23, line 4, as follows:

Meanwhile, when ~~phosphor~~ phosphorus is added to a large extent , ~~phosphor~~ phosphorus atoms that do not take part in compensation of dangling bonds on crystal grain boundaries come to overflow in crystals so that the crystals in the i-layer of μc-Si:H thin film seem to turn to n-type crystals to suppress depletion of the i-layer. Additionally, the large amount of ~~phosphor~~ phosphorus encourages amorphous regions to turn to n-type regions and suppresses depletion similarly. Therefore, this may be the reason why Jsc decreases as the ~~phosphor~~ phosphorus concentration increases.

Please amend the paragraph beginning at page 23, line 15, as follows:

If the ~~phosphor~~ phosphorus content ratio of the i-layer of the bottom cell and that of the i-layer of the middle cell of a stacked photovoltaic element according to the invention are R1 and R2 respectively, preferably the relationship of R1 and R2 is defined by the formula of

$$0.1\text{ppm} < R2 < R1 < 4\text{ppm}.$$

Please amend the paragraph beginning at page 23, line 22, as follows:

More specifically, since the i-layer of the middle cell contains ~~phosphor~~ phosphorus only to a small extent, it is possible to improve the spectral sensitivity relative to the wavelength range between 550 nm and 800 nm when the i-layer has a small film thickness. Then, additionally, light can get to the bottom cell to a large extent because of the small film thickness of the i-layer of the middle cell, it is also possible to improve the spectral sensitivity of the bottom cell.

Please amend the paragraph beginning at page 24, line 5, as follows:

Furthermore, since the i-layer of the bottom cell contains ~~phosphor~~ phosphorus to a relatively large extent, it is possible to achieve a high open-circuit voltage and a high FF value so that the spectral sensitivity to the wavelength range between 800 nm and 1100 nm of the bottom cell is sufficiently high.

Please amend the paragraph beginning at page 36, line 5, as follows:

The characteristics of the photovoltaic elements were observed by means of a solar simulator adjusted to AM1.5 and 100 mW/cm^2. Table 2 shows the average values obtained by observing the characteristics of the 400 photovoltaic elements. The ~~phosphor~~ phosphorus content ratios of the first i-layer and the second i-layer were observed by means of SIMS to find that they were respectively 1.6ppm and 0.6ppm relative to silicon.

Please amend the paragraph beginning at page 36, line 15, as follows:

A total of 400 triple cells were prepared as in Example 1 except that the ~~phosphor~~ phosphorus concentration in the i-layer of the middle cell was made equal to its

counterpart of the i-layer of the bottom cell and the current balance was adjusted by raising the film thickness of the i-layer of the middle cell. The characteristics of the photovoltaic elements were observed by means of a solar simulator. Table 2 also shows the average values obtained by observing the characteristics of the 400 photovoltaic elements of this example for comparison.